

Directory of the Proposed

NILGIRI

BIOSPHERE RESERVE

Draft

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WORLD CONSERVATION MONITORING CENTRE

The three partners in the World Conservation Strategy, IUCN, UNEP and WWF, have agreed to support jointly the restructuring and development of the IUCN-Conservation Monitoring Centre so that it can fulfil effectively its role as the focal point for information on the world's biological diversity. Renamed the World Conservation Monitoring Centre, the new Centre is registered in the U.K. as a company limited by guarantee and has applied to the U.K. Charity Commission for charitable status.

FOREWORD

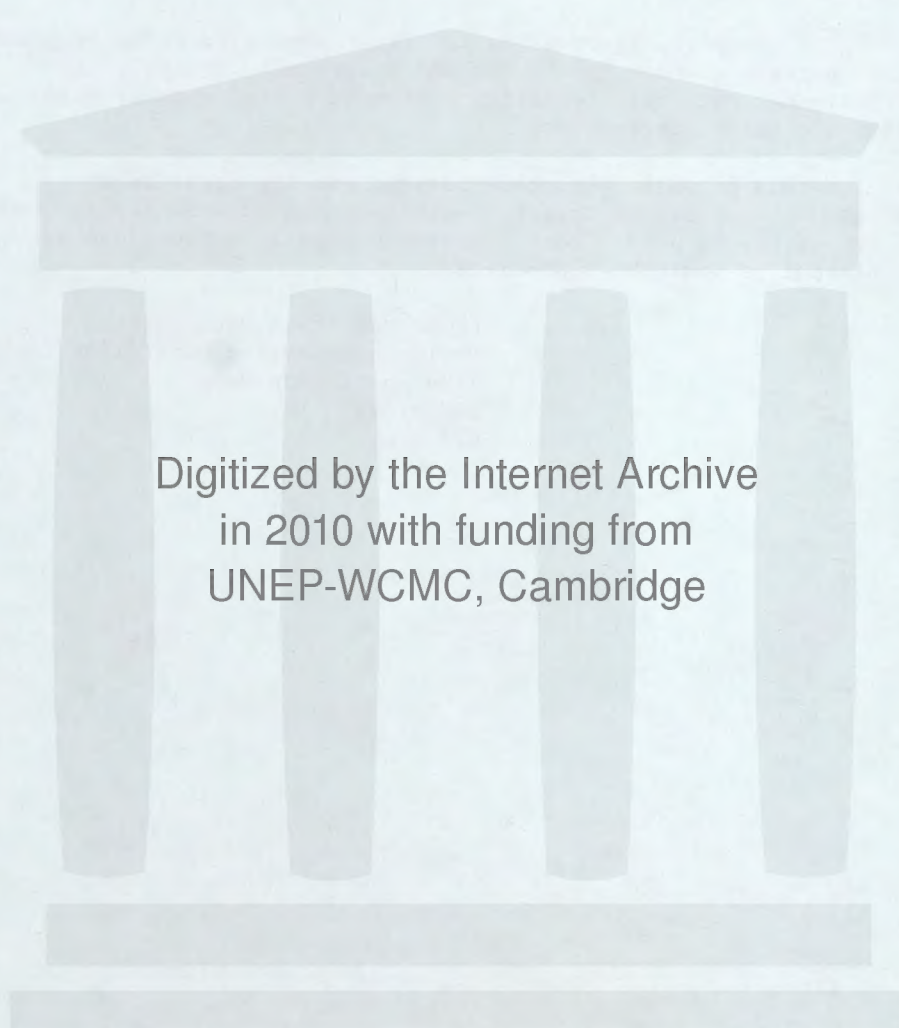
The Protected Areas Data Unit of the World Conservation Monitoring Centre, in collaboration with IUCN's Commission on Natural Parks and Protected Areas, is currently preparing a series of directories of protected areas within the Indo-malayan realm. These directories will comprise information sheets on protected area systems within each country, along with details on individual protected areas.

This site, Nilgiri Biosphere Reserve, is the first such site to be proposed by the Indian Government under the Unesco MAB programme. The proposed biosphere reserve covers several existing protected areas, notably three national parks and three sanctuaries.

Documentation on this proposed biosphere reserve and its constituent protected areas was compiled by Robert I. Atkinson and Sultana Bashir, under the supervision of Dr. M. J. B. Green. Review comments, corrections and additional information would be appreciated.

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NAME Proposed Nilgiri Biosphere Reserve

MANAGEMENT CATEGORY Proposed as a biosphere reserve. Details of individual protected areas are given in Appendix 1.

BIOGEOGRAPHICAL PROVINCE 4.01.01. (Malabar Rainforest)

GEOGRAPHICAL LOCATION Lies in the Nilgiri Hills and adjoining Western Ghats of Peninsular India, at the junction of the Karnataka, Kerala and Tamil Nadu borders. It stretches from Coorg Wynad Plateau just east of Brahmagiri, south to the Attapadi-Siruvani hills at the northern edge of the Palghat Gap, and eastward to the Talamalai-Hasanur Plateau of the Eastern Ghats. Mysore is about 50km from the north-western limb of the reserve, Coimbatore 10km from the northern extremity and Calicut 50km from the western boundary (Gadgil and Sukumar, 1986). 10°45'-12°215'N, 76°0'-77°15E

DATE AND HISTORY OF ESTABLISHMENT The Nilgiri Biosphere Reserve is in the process of being established although it has not yet been officially designated as such under the Unesco MAB programme. The proposed biosphere reserve consists of a number of protected areas (see Appendix 1). Much of the area has a long history of protection, with large tracts remaining relatively intact due to the inaccessibility of the forested mountains and administered as hunting reserves for Indian Royalty. Work pertaining to the proposed reserve was prepared in 1980 by the Indian Institute of Science, in consultation with the concerned government authorities. This was followed by a workshop on Conservation of Biological Diversity in March 1982 at the Indian Institute of Science. The reserve was proposed in August 1984, and its establishment was agreed at a meeting of the three state governments. In order to demarcate the boundaries of the proposed biosphere reserve, a committee was constituted with representatives from the governing states, Indian Institute of Science, Kerala Forest Research Institute and Centre for Wildlife Studies. Research work has already begun (Gadgil and Sukumar, 1986). Dates of establishment of individual protected areas within the proposed biosphere reserve area are listed in Appendix 1.

AREA 552,000ha, comprising a core zone of 124,000ha, manipulation forest zone of 323,900ha, tourist zone of 33,500ha and restoration zone of 70,000ha (Gadgil and Sukumar, 1986; Sukumar, 1987). Sizes of individual protected areas within the proposed biosphere reserve are given in Appendix 1.

LAND TENURE Land is state-owned within existing protected areas.

ALTITUDE Ranges from 250m in the Coimbatore and Calicut to 2,545m in the Upper Nilgiris, but the highest peak Doddabetta (2,636m) is outside the biosphere reserve.

PHYSICAL FEATURES The topography is extremely varied. To the north of the Upper Nilgiris are the Wynad, Mysore, Sigur and Talamalai plateaux with associated hills at a general altitude of 700m to 1,000m. On the west, the slopes constituting the Nilambur, New Amarabalam and Silent Valley descend to 250m in the Calicut Plains. To the south the Attapadi Plateau, Siruvani and Bolampatti hills show their own diverse topography from 1800m down to 250m in the Coimbatore Plain. Geologically the entire region is made up of metamorphic Archean (pre-Cambrian) rocks, mainly gneisses, charnokites and

schists. The region is drained both to the west and east. On the west, relatively short, swiftly flowing streams drain into the Chaliyar, Kunthipuzha and Kariyar rivers. The eastern portion is drained by the tributaries of the Kabbini Mayar and Bharani rivers, which ultimately flow into Cauvery River (Gadgil and Sukumar, 1986).

CLIMATE There are three main climatic regimes: (1) warm and wet tropical, below 1400m, in the lower Coonoor Ghat, south-eastern slopes, Malabar Plains, and western parts of the Mysore Plateau; (2) warm and dry tropical, below 1400m, in the Coimbatore Plains and eastern Mysore Plateau; (3) cold and wet tropical, above 1400m, in the upper Coonoor Ghat, Kundak Range and Doddabetta Range. The region is subject to the influence of both south-west and north-east monsoons. On the western exposed portions of the Upper Nilgiris mean annual rainfall exceeds 5000mm. A maximum of 6330 mm has been recorded on Murkurti Ridge at 2,545m, while in the sheltered Moyar Valley, only 40km away, it is less than 500mm. Mean monthly daily temperatures reach a minimum of 2°C (February) at Karakundral and 37.1°C (July) at Bhavanisagar. Absolute minimum and maximum temperatures are -6.7°C and 41.1°C, respectively, for both these stations (Gadgil and Sukumar, 1986; Anon., 1986).

VEGETATION Vegetation types range from wet evergreen forest to dry thorn forest. (1) Tropical wet evergreen forest occurs up to an altitude of 1500m along western slopes where annual rainfall exceeds 2000mm. This is characteristic of Nilambur Kovilakam, New Amarambalam, Silent Valley and parts of Attapadi. Among dominant trees the common association is the Dipterocarpus-Mesua-Palaquim series. Common trees include D. indicus, M. Ferrea, P. ellipticum, Artocarpus hirsuta, Bischofia javanica, Garcinia indica, Hopea parviflora, H. Wightiana, Kingiodendron pinnatum, Michelia nilagirica, Pterospermum reticulatum, Syzygium gardneri, Diospyros spp. and Cinnamomum zeylanicum. Due to the closed canopy the ground is usually devoid of grass. (2) Tropical montane evergreen shola-grassland vegetation occurs above 1,500m over the greater part of the Upper Nilgiri Plateau and the higher reaches of the Siruvani Hills. Shola forests are restricted to the valleys or folds in the hills, while surrounding hill slopes are covered with grass. Principal trees in the forest include Cinnamomum wighti, Elaeocarpus spp., Gordonia obtusa, Meliorma spp., Liquortrum voxburghii, Litroea spp., Schefflera spp., Symplocos spp. and Syzygium arnottianum. Undergrowth contains members of Rubiaceae and Acanthaceae, especially Strobilanthes. Grassland contains species from the genera Cymbopogon, Themeda, Eragrostis, Bothriochloa and Tripogon. (3) Tropical semi-evergreen forest, transition between evergreen and moist deciduous types, is found both along lower western slopes and below the montane shola vegetation of northern slopes. Vitex altissima, Persea macrantha, Holigarna arnottiana, Acrocarpus fraxinifolius, Bombax ceiba, Trewia nudiflora, and Caryota urens are present as well as an element of the evergreen forest. Common deciduous trees include Lagerstroemia lanceolata and Xylia xylocarpa. (4) Tropical moist deciduous forest is best represented in the Wynad Plateau. Principal trees are Lagerstroemia lanceolata, Terminolia tomentosa, Dalbergia latifolia, Schleichera aleosa, Xylia xylocarpa, Kydia calycina and Tectona grandis. The lower storey may contain clumps of Bambusa arundinacea with tall grasses (Themeda spp. and Cymbopogon spp.) at ground level. (5) Tropical dry deciduous forest dominates the Mysore Plateau, Talamalai Plateau and a large portion of the Nilgiri rainshadow slopes. Anogeissus latifolia is usually dominant due to frequent fires. Other trees include Tectona grandis, Terminalia tomentosa, T. chebula, Albizia odoratissima, Grewia tiliaefolia, Pterocarpus marsupium, Chloroxylon swietenia and Adina cordifolia. Dendrocalamus strictus is the common bamboo of dry

forests. The ground layer is dominated by species of the grasses Themeda, Cymbogon, Imperata and Heteropogon. In many areas a modified scrub thicket of Acacia spp. and Lantana spp. is present, with only short grasses. (6) Tropical dry thorn forest is best seen in Moyar Valley. Acacia leucophloea, A. chundra, A. latronum, Albizia amara, Hardwickia binata, Zizyphus xylopyrus, Gyrocarpus jacquini, Dicrostachys cinerea, Xeromphis spinosa, Erythroxylum monogynum and Capparis sepiaria are the common species, with short grasses constituting the ground layer. This type of vegetation was characteristic of the Deccan Plateau and it is important that remaining areas are protected (Gadgil and Sukumar, 1986).

FAUNA More than 100 species of mammals, 550 species of birds, 80 species of reptiles and amphibians have been recorded in the area (Anon., 1983). Primates include Hanuman langur Presbytis entellus, Nilgiri langur Presbytis johnsi, Bonnet macaque Macaca radiata and the rare lion-tailed macaque Macaca silenus (E), which is restricted to Silent Valley National Park. Predators include tiger Panthera tigris (E), of which there are an estimated 19 animals in Bandipur National Park (1978), leopard Panthera pardus (T), which is most frequent in over-grazed degraded forest, wild dog Cuon alpinus (V), which is widespread, jackal Canis aureus, striped hyena Hyaena hyaena, Indian fox Vulpes bengalensis and sloth bear Melursus ursinus (I).

There are approximately 1,500 elephants Elephas maximus (E) in Mudumalai, Bandipur and Nagarhole; this population migrates from the wetter to the drier forests during the summer monsoon (Nair et al., 1978). Most important among the ungulates is Nilgiri tahr Hemitragus hylocius (V) of which there are an estimated 400-450 in the biosphere reserve (Davidar, 1978; Rice, 1984). Also present is gaur Bos gaurus (V), whose population crashed in 1968 due to a rinderpest epidemic. Other ungulates include sambar Cervus unicolor, spotted deer C. axis, Indian muntjac Muntiacus muntjak and mouse deer Tragulids meminna, all of which are common, and four-horned antelope Tetracerus quadricornis, which is rarely seen (Nair et al., 1978). Small mammals include black-naped hare Lepus nigricollis and giant squirrel Ratufa indica (Nair et al., 1978).

The diverse habitat accounts for the large number of bird species. Rarities include, Great Indian hornbill Buceros lucornis and Ceylon frogmouth Batrachostomus moniliger. Only five Ceylon frogmouth were recorded during a survey of Silent Valley National Park (Nair et al., 1978; Anon., 1983).

Among reptiles, mugger crocodile Crocodylus palustris (V) has become rare due to poaching and loss of habitat.

CULTURAL HERITAGE Remains of temples, villages and water tanks provide evidence of a previous culture, which developed a system of irrigation. The khedda method of elephant capture was traditionally used in the north of the reserve. In addition to Kanadigas, Tamils and Malyalis, there are 20 ethnic groups within the area (see Appendix 2), notably the Cholanaiiks, who are the only genuine hunter-gatherers of the Indian peninsula (Nair et al., 1978; Gadgil and Sukumar, 1986).

LOCAL HUMAN POPULATION There is a large number of villages and townships in the area (Anon., 1983). Livelihood varies according to ethnic origins: for example Cholanaiiks are hunter-gatherers while Todas are mainly pastoralists. Other sources of livelihood include forest plantations and tea estates. Millet is cultivated in drier tracts of Talamalai and Sigur, while rice paddy is grown in the moister Wynad belt (Gadgil and Sukumar, 1986; Anon., 1983; Nair et al., 1978; Larson, 1987).

VISITORS AND VISITOR FACILITIES No facilities are yet provided specifically for the biosphere reserve but many of the protected areas within its boundaries, notably Bandipur National Park, offer a range of facilities. Visitor numbers at Bandipur, the most frequented protected area in the region, are approximately 30,000 per year.

SCIENTIFIC RESEARCH AND FACILITIES The first reconnaissances were made by Portuguese priests who twice visited the area in 1600. It was not until 1812 that the area was officially visited by a British civil servant. This was followed by a major expedition in 1818-1819, to reconnoitre the area for prospective settlement (Larsen, 1987). General ecological surveys of the area were completed by Nair *et al* (1978) during 1974 and 1975. Beginning in 1980, a scientific programme, including a zonation plan, was drawn up by the Indian Institute of Science. Research on mammals includes studies on elephant (Salim, *et al*, 1985), Nilgiri tahr (Davidar, 1963, 1976 and 1978; Rice, 1984), and lion-tailed macaque (Kumar, 1987). Avifaunal studies include those of Gray (1974), Khan (1974-76) and Sugathan (1981). Butterflies were first collected by Sir George Hampson (cited in Larson, 1987), later by Wynterblyth (1944-46) and more recently they were studied by Larson (1987). Planned work includes topographic, geological, geomorphological and vegetation surveys, inventories of fauna and flora and long-term monitoring of meteorological conditions (Gadgil and Sukumar, 1986).

CONSERVATION MANAGEMENT Nilgiri Biosphere Reserve has been identified as the first Indian biosphere reserve due to its great diversity of habitats and species, including populations of several threatened and endemic taxa. A system of zonation is planned, with a core zone containing the whole range of biological diversity, a manipulation or buffer zone, a restoration zone and an as yet undefined zone of co-operation. Use of the core zone would be restricted to scientific research. The manipulation zone would accommodate on-going forestry, agriculture, animal husbandry and other practices. The restoration zone is intended for research into ways of restoring productivity and diversity of degraded ecosystems (Gadgil and Sukumar, 1986).

Management of Nilgiri Biosphere Reserve will be a collaborative effort involving scientists, administrators and the local population. Recommendations include strengthening existing organizations to take on the task of research, provision of extra staff by government organizations and development of a central, computerised data centre for more efficient flow of information (Gadgil and Sukumar, 1986).

MANAGEMENT PROBLEMS Main threats are fires and the conflicting interests of forestry operations, water resource development, cultivation and grazing.

STAFF No information

BUDGET No information

LOCAL ADMINISTRATION No information

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76° 15'

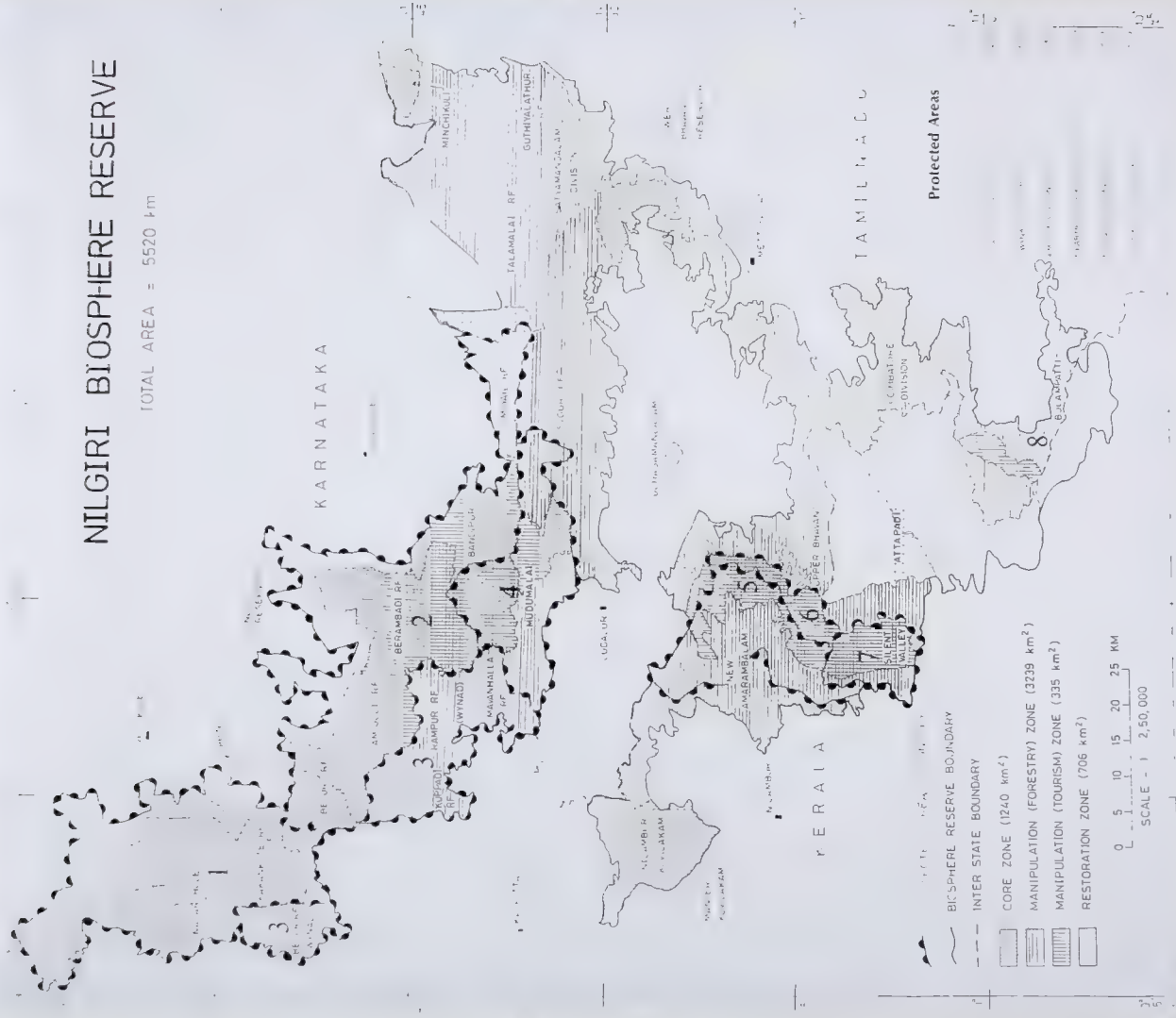
76° 30'

76° 45'

77° 0'

77° 15'

77° 30'

TOTAL AREA = 5520 μm^2 

Appendix 1

- A. List of existing and proposed protected areas within proposed Nilgiri Biosphere Reserve, with year of establishment, size and details of proposed extensions (Source: Rodgers and Panwar, 1988)

<u>Name</u>	<u>Year</u>	<u>Size</u>	<u>Proposals</u>
Bandipur National Park	1974	87,400ha	
Nagarhole National Park	1974	57,200ha	Extend to 72,100ha
Silent Valley National Park	1980	8,951ha	
Mudumalai Sanctuary	1940	32,100ha	upgrade and extend to create national park core of 20,000ha and surrounding sanctuary of 25,500ha
Nilgiri Tahr Sanctuary	?	7,864ha	upgrade to national park status
Wynad Sanctuary	1973	34,400ha	extend by 14,400ha
Bolampatti Reserved Forest			upgrade to a 10,700ha sanctuary
Karimpuzha National Park			designate an area of 25,500ha

- B. List of forest reserves within the area of the proposed Nilgiri Biosphere Reserve, a number of which occur in existing protected areas (Source: Anon., 1983)

Ainurmagudi	Kurchiyat
Arakeri	Maranhalaa
Attapadi Valley	Melkunda
Avarhalla	Metkuppe
Bandipur	Moyar
Beerambadi	Murkurti
Begur	Muthikulam
Benne	Nalkeri
Bolampatti	New Amarambalam
Chelnayar	Nilambur Vested Forest
Edakode	Nilgiri East Slopes
Hotgot	Nilgiri Peak
Jakkanare	Nulpuzha
Kachuvanhalli	Porthmund
Kakankote	Rampur
Kaniyanpura	Sigur
Kattikulam	Taishola
Kumbarkolli	Talamalai
Kunda	Tittimati
Kundrekode	

Appendix 2

List of tribes inhabiting the proposed Nilgiri Biosphere Reserve
(Source: Anon., 1983).

Adujans	Malmuthans
Alars	Mullukurbeans
Aranadans	Pahinaikas
Cholanaiks	Paniyans
Irula	Pariyans
Kalanaiks	Pulayans
Kunduradigans	Tackanadmuppans
Kurchiyans	Todas
Kurumans	Uralikurulians
Kurumba	Wynad Kaders

NAME Bandipur National Park

MANAGEMENT CATEGORY II (National Park)

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION Situated 80km from Mysore City in Mysore District, on the border with Kerala to the south and Tamil Nadu to the west. The national park lies at the heart of an extensive forest at the confluence of the Western Ghats and Nilgiri Hills. 11°20'–11°40'N, 76°20'–76°32'E

DATE AND HISTORY OF ESTABLISHMENT Created a national park in 1974. Originally established as a sanctuary in the early 1930s with an area of 6,000ha. The sanctuary was elevated in status and enlarged to 80,300ha in 1941 and renamed Venugopal Wildlife Park after a temple. The national park is included in the proposed Nilgiri Biosphere Reserve (Basappanavar, 1983, 1985; Rodgers and Panwar, 1988; Sestiadti, 1986).

AREA 87,400ha, comprising a wilderness zone of 33,500ha, buffer zone of 43,400ha, tourism zone of 10,500ha and an administration zone of 100ha. Initially in 1974, the tiger reserve comprised 69,000ha of the national park; the remaining 18,400ha of the park came under Project Tiger in 1984. The park is contiguous to Nagarhole National Park (57,200ha), Mudumalai Sanctuary (32,100ha) and Wynad Sanctuary (34,400ha) (Rodgers and Panwar, 1988; Neginhal, 1974).

LAND TENURE State

ALTITUDE Ranges from 780m to 1,455m, at the top of Gopalswamy Betta (Basappanavar, 1985).

PHYSICAL FEATURES The terrain is undulating and broken by chains of hills, flat-topped hillocks and water-courses. The reserve is drained by the Kubini, Nugu and Moyar rivers and by the Bavali, Moolehole, Kekkanalla, and Marandi streams. The River Moyar has cut a picturesque gorge, known as Mysore Ditch, which is 260m deep (Neginhal, 1974). Underlying rocks are mainly metamorphic: gneiss, quartzite, mica, and hornblende schists are generally widespread. Igneous intrusions of granite and charnokite appear as out crops at high levels and in the beds of water courses (Neginhal, 1974). The soil is usually a mixture of red laterites and black cotton soil, but the latter does not show a higher concentration of salt. In some places sandstones, semi-quartzites and shales are present (Jain and Sastry, 1983).

CLIMATE Cold, dry and wet seasons are distinguished. The cold season lasts from November to mid-February, and is followed by a dry season lasting until June. The wet season starts mid-June, though heavy pre-monsoon showers fall in April and May. Temperatures range between 18–24°C in November and 21–33°C in June (Sestiadti, 1986; Neginhal, 1973).

VEGETATION Three main types of vegetation are evident: scrub, in the eastern most portion; tropical dry deciduous forest, which occurs in the central portion, in areas of poor site quality, with shallow hard soil, flat floor and low rainfall; and tropical moist mixed deciduous forest in the western part.

Scrub is characterised by stunted tree growth in areas of shallow hard soil with almost no humus. Shorea talura, sandal Santalum album, Terminalia chebula, Anogeissus latifolia, Azadirachta indica, Chloroxylon swietenia, Acacia leucophloea, A. catechu, Stereospermum chelonoides, Zizyphus spp., Diospyros melanoxylon and Diospyros montana are predominant.

Tropical dry deciduous forest comprises a top canopy of Anogeissus latifolia, Tectona grandis, Terminalia tomentosa, T. belerica, T. chebula, T. paniculata, Pterocarpus marsupium, Dalbergia latifolia, D. paniculata, Grewia tillaefolia, Salmalia malabarica, Gmelina arborea, Albizzia odoratissima, Coreya arborea, Schleichera trijuga, Odina wodier, Stereospermum chelonoides, S. xylocarpum, Schrebera swietenoides, Butea monosperma, Embilica officinalis, Lagerstroemia parviflora and Gardenia spp., and a lower canopy of Vangueria spinosa, Randia dumetorum, R. uliginosa, Wrightia tinctoria, Zizyphus jujuba, Z. xylocarpus, Santalum album, Kydia calycina, Bridelia retusa, Shorea talura and Cassia fistula. Undergrowth is mainly grasses and Lantana sp.

Tropical moist mixed deciduous forest, the most valuable forest of the state, used to feature extensive stands of bamboo (Bambusa arundinacea and Dendrocalamus strictus), much of which died off after flowering. Top canopy species include: Tectona grandis, Lagerstroemia lanceolata, Terminalia tomentosa, T. belerica, Dalbergia latifolia, Pterocarpus marsupium, Salmalia malabarica, Adina cardifolia, Grewia tillaefolia, Anogeissus latifolia, Stereospermum xylocarpum, Schleichera oleora, Albizzia odoratissima, Odina wodier, Ficus infectoria and other species of Ficus. The lower canopy consists of Embilica officinalis, Mallotus philippinensis, Kydia calycina, Butea monosperma, Zizyphus xylocarpus, Vangueria spinosa, Grewia tillaefolia, Gmelina arborea, Bridelia retusa, Bauhinia racemosa, Cassia fistula, Cordia myxa and Randia dumetorum. The undergrowth comprises Kydia calycina young growth, Solanum ferox, S. indicum, Helicteris isora, Hemidesmus indicus, Holarrhena antidysenterica, Lantana camara, Eupatorium dermodium sp., Fleminga sp., Veronia sp., and Grewia hirsuta (Neginhal, 1974).

FAUNA The park is very rich in wildlife. Two species of primate are present: common langur Presbytis entellus and bonnet macaque Macaca radiata. Among the larger carnivores are tiger Panthera tigris (E), leopard Panthera pardus (T), wild dog Cuon alpinus (V), jungle cat Felis chaus and sloth bear Melursus ursinus (I). Less common are striped hyena Hyaena hyaena and jackal Canis aureus. Large herbivores include Indian elephant Elephas maximus (E), of which there are approximately 700-800 animals (Salim et al., 1985), mouse deer Tragulus meminnia, Indian muntjac Muntiacus muntjak, spotted deer Cervus axis, sambar C. unicolor, four-horned antelope Tetracerus quadricornis, gaur Bos gaurus (V), and wild boar Sus scrofa. Indian porcupine Hystrix indica and Indian hare Lepus nigricollis are present. Reptiles include mugger crocodile Crocodylus palustris (V) in the Nugu River and python Python molurus (V).

Over 180 bird species have been recorded, including malabar whistling thrush Myophonus robinsoni, malabar pied hornbill Anthracerus coronatus, laggar falcon Falco jugger, malabar trogon Harpactes fasciatus and grey jungle-fowl Gallus sonneratii. These are listed in Neginhal (1974). Other details are given by Sharatchandra (1975), and Johnsingh (1983, 1984).

CULTURAL HERITAGE The national park features many of the water tanks characteristic of this region, and also derelict temples and villages. There is an old fort and a famous ancient temple on Gopalswamy Betta, suggesting large-scale cultivation and occupation in the past.

LOCAL HUMAN POPULATION Details of villages in and around the park, including size and ethnic origins are given by Neginhal (1974). There are 27 villages within 3km of the national park, all of which have a detrimental effect, another two villages were moved out of the park in 1976. The more common tribes are Kurubas, Solagas and Pariwars. The main source of livelihood is agriculture. Crops raised are rice paddy, sugarcane, jowar, ragi, kuvali, bengalam, groundnut, til and turdal. Kurumbas, shifting cultivators, have been relocated by the Government. Six cattle camps were removed from within the park in 1976 (Basappanavar, 1976), however, cattle from the villages graze upto the border of the park (Neginhal, 1974).

VISITOR AND VISITOR FACILITIES The national park received some 30,000 visitors per year in the early 1980s, about one third of which were foreigners. Some 84 beds in various cottages and dormitories are available for tourists. In addition there are 9 forest lodges for use by inspecting officers. There is an information centre at Bandipur camp, with a children's library, and a guide service is available (Basappanavar, 1985).

SCIENTIFIC RESEARCH AND FACILITIES Much work on the wildlife of the park been done by the Indian Institute of Science in Bangalore, Dr Gadgil (1974) and A.J.T. Johnsingh (1983), who completed a long-term study of wild dog (1984). An ecological reconnaissance by Nair *et al.*, (1978) referred to the formation of the Jawahar National Park, especially in context to elephant habitat, and also research under the project tiger scheme, 'Operation Census' of elephants was carried out in the park on the 30th April, 1983 (Basappanavar, 1983).

CONSERVATION MANAGEMENT The national park contains the entire area of the tiger reserve and will be split into; core, manipulation tourism and restoration zones, on formation of the Nilgiri Biosphere Reserve. The management plan provides for a wilderness or core zone, which is protected, buffer zones, in which wildlife-oriented forestry practices are permitted, tourist zone for the development of wildlife tourism, and an administration zone for park offices and visitor accommodation. An immediate objective detailed in the plan is to stop grazing (Neginhal, 1974).

MANAGEMENT PROBLEMS Cattle belonging to people relocated under the Kabini Reservoir scheme are damaging forests adjoining the national park. Although cattle from nearby villages are inoculated against rinderpest, similar preventitative measures have not been taken against foot and mouth disease. Poaching and fires are continual problems.

STAFF Field director, deputy director, assistant conservator of forests, six park rangers, 17 foresters, 86 park guards and seven park watchers. In addition six anti-poaching and two anti-smuggling squads (eight to ten men per squad).

BUDGET No information.

LOCAL ADMINISTRATION Field Director, Bandipur Tiger Reserve, Government House Complex, Mysore

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ZONING OF BANDIPUR TIGER RESERVE

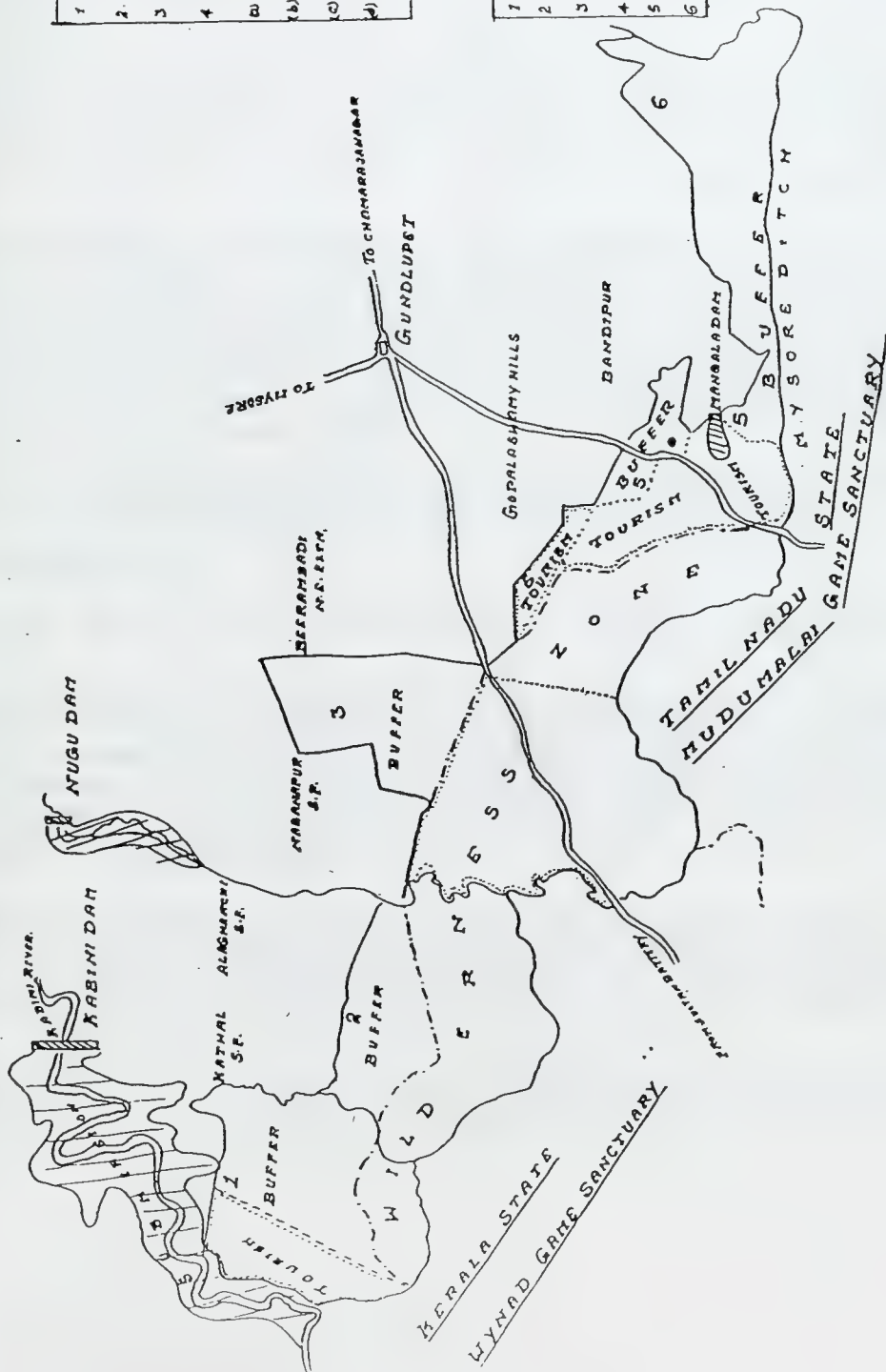
SCALE 1" = 4 MILES
OR 1 CM = 2.55 KM.

REFERENCES

1 WILDERNESS ZONE	354.56 km
2 TOURISM ZONE	85.41 km
3 BUFFER ZONE	249.55 km
4 ADMINISTRATIVE SETTLEMENTS	
(a) BANDIPUR CAMPUS AREA	50.00 HCT
(b) MANGALADAM AREA	15.00 "
(c) MOLEMOLE AREA	15.00 "
(d) GODALSHAMMY MILLS	20.00 "

INDEX

1 BEAR STATE FOREST
2 ANI NURMARIGUDI "
3 BEERABGADI "
4 BANDIPUR "
5 KANIYANPUR "
6 MOYAR "



Source: Neginhal et al., (1974). Project Tiger - Management plan for the Bandipur Tiger Reserve. Karnataka State. 142 pp.

NAME Nagarhole National Park

MANAGEMENT CATEGORY Core zone II (National Park)
Other zones IV (Managed Nature Reserve)

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION Situated within the south-eastern parts of Koodogu (Coorg) and south-western parts of Mysore District. It borders on Kerala State and Mysore Town is about 50km to the north-east. The southern border is contiguous with the reservoir of the dammed Kabini River. The south-eastern boundary follows the state border and the western border running along the main Mysore-Mangalore road. The northern boundary extends along this road to just south of Hunsur and the eastern boundary runs from this point south to the Kabini Reservoir. The Brahmagiri Mountains are to the west of the park (Karanth, 1983; Israel and Sinclair, 1987). 11°55'-12°20'N, 76°10'-76°20'E

DATE AND HISTORY OF ESTABLISHMENT Created a national park in 1974. Originally designated a 28,700ha game sanctuary in 1955, centred on Nagarhole settlement. Enlarged to its present size in 1974 by combining Mysore forests and Nagarhole Sanctuary. Proposed extensions to the national park total 14,400ha and include the Kaveri River forests to the north and the remaining part of the Kakankote Reserve Forest (Rodgers and Panwar, 1980; Karanth, 1987). The national park is included in the proposed Nilgiri Biosphere Reserve (Gadgil and Sukumar, 1986).

AREA 57,200ha. The national park is contiguous with Bandipur National Park (87,400ha) and Kakankote Reserve Forest (7,500ha) to the south.

LAND TENURE State

ALTITUDE Ranges from 600m to 900m (Sestiadti, 1986) with a mean altitude of 700m.

PHYSICAL FEATURES The landscape is generally one of gentle slopes and shallow valleys. The largest river draining the area in the south is the Kabini, which was dammed in 1974. Other important rivers include Lakshmana, Teentha and Nagarhole. There are several perennial and seasonal streams and tanks, all of which drain into the four major rivers. Swamps (hadlus) are numerous in the Coorg Wynad due to the high rainfall (Sestiadti, 1980; Israel and Sinclair, 1981; Karanth, 1983).

CLIMATE Three seasons are usually recognised: a wet season or monsoon, lasting from June to September; followed by a cool season that lasts up to January; and then a hot season from February to May. Seasonal variations in temperature are moderate, ranging from between 15°C and 28°C. Rainfall is usually about 1500mm per year (Israel and Sinclair, 1987).

VEGETATION There are two main types of vegetation: moist deciduous forest which is found in northern and western parts where rainfall is usually above 1200mm; and dry deciduous forest in the south-eastern part.

Moist deciduous forests are tall and dense with a two-storey canopy. The upper canopy, at approximately 30m, is dominated by mathi Terminalia tomentosa, nandi Lagerstroemia lanceolata, honne Pterocarpus marsupium, tadasalu Grewia tilaefolia, rosewood Dalbergia latifolia and teak Tectona grandis. The lower canopy has the prolific fruit yielders: nelli Phyllanthus emblica, kooli Gonclina arborea, kadutega Dillenia pentagyna and Randia spp. The shrub layer is usually very dense and varied in composition. A unique feature of these forests is the open grassy swamps, locally called hadlus, where the grass is lush year-round. In the dry deciduous forests, the canopy is lower and trees are more widely spaced. A second canopy is barely discernable. Many moist forest trees are present: dindalu Anogeissus latifolia is usually the commonest; kakhe Cassia fistula, flame-of-the-forest Butea monosperia and bamboo Dendrocalamus strictus are all common. Patches of open grassland are present (Karanth, 1983; Israel and Sinclair, 1987). Bamboo flowered and died off in 1965, an event which occurs every 40-50 years (Sestiadti, 1986). Much of the park is covered by plantations of teak and species of eucalyptus (Nair et al., 1978).

FAUNA The fauna is very diverse. Primates include langur Presbytis entellus, bonnet macaque Macaca radiata and slender loris Loris tardigradus. Notable carnivores are tiger Panthera tigris (E), which is present in larger numbers than in Bandipur National Park, leopard Panthera pardus (T), leopard cat Felis bengalensis, jungle cat F. chaus, jackal Canis aureus, wild dog Cuon alpinus (V), sloth bear Melursus ursinus (I) and rarely hyena Hyaena hyaena (Salim et al., 1985). Herbivores include elephant Elephas maximus (E), with a population of approximately 300 animals, spotted deer Cervus axis, sambar C. unicolor, Indian muntjac Muntiacus muntjak, four-horned antelope Tetracerus quadricornis, mouse-deer Tragulus meminna, gaur Bos gaurus (V) and wild boar Sus scrofa. Small mammals include: civet Viverricula indica, common palm civet Paradoxurus hermaphroditus, mongooses Herpestes fuscus and H. vitticollis, common otter Lutra lutra (V), hare Lepus nigricollis, pangolin Manis crassicaudata, giant flying squirrel Petaurista petaurista, giant squirrel Ratufa indica maxima and porcupine Hystrix indica (Nair et al., 1978; Salim et al., 1985).

Over 250 species of birds are present, including the endemics malabar trogon Harpactes faciatus and malabar pied-hornbill Anthracoceros coronatus, and birds of prey such as crested hawk-eagle Spizaetus cirrhatus and crested serpent-eagle Spilornis cheela.

Among reptiles, mugger Crocodylus palustris (V), monitor lizard Varanus bengalensis, and rock python Python molurus (V) are present (Nair et al., 1978; Karanth, 1983; Salim et al., 1985; Israel and Sinclair, 1987).

CULTURAL HERITAGE The ruins of towns, villages and an extensive network of irrigation channels and tanks are still evident (Sestiadti, 1986). When the Kabini recedes the remains of a khedda (stockade), used to catch elephants during the 19th Century, can be seen (Israel and Sinclair, 1987).

LOCAL HUMAN POPULATION The towns of Nagarhole and Murkal lie in the reserve, while Mastigudi is to the south. Local people are allowed to cultivate swamps, collect minor forest products and graze livestock in areas outside the core zone (Karanth, 1983).

VISITORS AND VISITOR FACILITIES There are forest rest houses at Nagarhole, Kalhalla, Murkal and Trithimathi. Organised trips to view wildlife are available. Observation towers may be used with permission from the park staff (Sestiadti, 1986).

SCIENTIFIC RESEARCH AND FACILITIES Research includes censuses of the elephant population (Sharatchandra and Gadgil, 1976; Nair et al., 1978). An ecological survey of the proposed Jawahar National Park was carried out by the Indian Institute of Science (Nair et al., 1978).

CONSERVATION MANAGEMENT The area contains the habitat of several rare and endangered species, notably tiger. Much of it has been protected from development because the Indian royalty used the area as a hunting park. Nagarhole is part of the protected areas complex, including Bandipar National Park, Wynad Sanctuary and Mudumalai Sanctuary, that is proposed as the Nilgiri Biosphere Reserve. As part of the biosphere reserve, the national park will be divided into core, manipulation forestry, manipulation tourism and restoration zones (Sestiadti, 1986).

MANAGEMENT PROBLEMS The main threats are from clear-felling and the presence of a saw-mill within the national park, tribal cultivations, pig rearing, and goat breeding (Karanth, 1983).

STAFF No information

BUDGET No information

LOCAL ADMINISTRATION No information

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NAME Silent Valley National Park

MANAGEMENT CATEGORY II (National Park)

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION Situated at the south-western corner of the Nilgiri Hills, in the Kundali Hills of the Western Ghats, in Mannarghat Taluk, Palghat District. Mannarghat, the nearest town, is approximately 30km to the south. The park is bounded by Attappadi Reserve Forests to the east and Palghat Division vested forests to the south. The Nilambur Division vested forests define the western boundary. The rest of the northern boundary is contiguous to the Nilgiri Forests. More detailed descriptions of park boundaries are provided by Anon. (1981) and Anon. (1982). Approximately 11°00'-11°15'N, 76°20'-76°30'E

DATE AND HISTORY OF ESTABLISHMENT The Silent Valley Forests, or 'Syrendhrivanam', considered by many to be one of the last representatives of virgin tropical evergreen forest in India, became the focus of India's perhaps fiercest and most widely-publicised environmental debate in the late 1970s, when the Kerala State Electricity Board (KSEB) decided to go ahead with a hydroelectric project in the valley (Agarwal *et al.*, 1985; Anon., 1982). The project was to generate 240MW of electricity and irrigate some 100,000ha in the relatively underdeveloped Palghat and Malappuram districts. It entailed the submergence of 830ha, including 500ha of prime tropical evergreen forest, as well as the temporary residence of a 3,000-strong workforce (Anon., 1982). A task force of the National Committee on Environmental Planning and Coordination, Dr M S Swaminathan, the then Secretary of Agriculture of the Government of India, and several non-governmental conservation organisations, including the Bombay Natural History Society and the Kerala Sastra Sahitya Parishad (Kerala Science and Literature Society), were among those who strongly urged the Kerala government to abandon the scheme, but to no avail (Anon., 1982). The dispute became highly politicised (IUCN, 1986): conservationists were accused of being anti-development and sentimental, while the proponents of the scheme were considered to have political motives by seemingly providing employment through development of the Malabar region. The extreme and diametrically opposed viewpoints are well summarised in the report of the Joint Committee which came down in favour of the environmentalists' case (Anon., 1982). Innumerable state and national organisations, as well as international organisations such as IUCN and WWF, became involved in the 'Save Silent Valley' campaign (see Variava, 1983). In a bid to placate environmentalists, the Government of Kerala created a national park on 26 December 1980 (SRO 1288/80), but it excluded the proposed project site from the area. In November 1983 the project was finally shelved in deference to the sentiments of the then Prime Minister, Mrs Indira Gandhi, although the then Government of Kerala refused to endorse the Joint Committee's findings (Agarwal *et al.*, 1985). The present national park, including the project area, was declared on 15 November 1984 (SRO 1462/84). It is included in the Nilgiri Biosphere Reserve, which is yet to be officially accepted by Unesco.

AREA 8,951.65ha (Kerala Forest Department, pers comm., 1987). The park is contiguous to Nilgiri Tahr Sanctuary (7,800ha) to the north-east in Tamil Nadu.

LAND TENURE State government

ALTITUDE Generally varies from 880m to 1,200m (Anon., n.d.). Balakrishnan (1984) gives a range of 658–2,383m. High peaks such as Anginda (2,383m), Sispara (2,206m) and Kozhipara (1,904m) occur in the northern part of the park.

PHYSICAL FEATURES A high continuous ridge runs along the entire northern, north-eastern and eastern boundaries and a lower, irregular ridge runs along the whole southern and western boundaries (Anon., 1982). The park is approximately 15km long from north to south and some 7km wide, being broadest at the southern end and becoming progressively narrower to the north. It is flanked by steep escarpments to the south and west which descend some 1,000m to the plains of Kerala, and by sheer cliffs to the north and east which rise a further 1,000m to the Upper Nilgiri Plateau. Kuntipuzha River flows southwards through the entire length of the park, dividing it into a narrow western sector (of less than 2km and a wider eastern sector of 5km). The valley is drained chiefly by five main tributaries of the Kuntipuzha which originate near the eastern border and flow westwards. Only a few minor streams drain into the Kuntipuzha in the western sector (Anon., 1981). The river is uniformly shallow and has no flood plains or meanders. It is one of the less torrential rivers of the Western Ghats (Anon., 1982), with a pesticide-free catchment area. Forests stand on laterite soils and laterites. Soils are blackish and slightly acidic in evergreen forests where there is good accumulation of organic matter (Anon., 1981). The underlying rock in the area is granite with schists and gneiss, which give rise to the loamy laterite soils on slopes (Anon., n.d.).

CLIMATE Annual temperatures generally vary from 12°C to 25°C in the northern (higher) part and from 15°C to 40°C in the southern part (Anon., 1981). Mean annual rainfall calculated from data for 1965–1973 is 3180mm, with a range of 2800–3450mm (Balakrishnan, 1984). This is considerably less than that of 5750mm, based on data from 1958–1963 (Anon., 1981). Rainfall is maximal during the south-west monsoon from July to August, and minimal from December to January. There is significant rainfall during the north-east monsoon in October and November. The dry season lasts from November/December to April/May (Anon., 1981). Relative humidity is high throughout the year (Anon., 1982).

VEGETATION There are approximately 300ha of grassland and 530ha of prime, undisturbed forest (Swaminathan, 1983). Most of the slopes and the valley are covered with dense tropical wet evergreen forest (Anon., n.d.). Grasslands predominate in the narrow sector, west of the Kuntipuzha and on the higher slopes and hill tops in the eastern sector. Forests form belts on either side of the tributaries of the Kuntipuzha in the eastern sector and occur in pockets west of the Kuntipuzha. Evergreen forest occurs up to the banks of the Kuntipuzha, an indication of the absence of destructive fluctuations in water level during the monsoon (Anon., 1982). Singh *et al.* (1984) give a detailed account of the structure, composition, regeneration status, and plant diversity of the Silent Valley Forests. Kerala Forest Department (1986) has compiled a list of common plants. The Botanical Survey of India has recorded nine new plant species and one new plant genus, as well as many rare, endemic and economically valuable species, such as cardomom *Ellettaria cardomomum*, pepper *Piper nigrum*, tuber-yielding *Dioscorea* spp., beans *Phaseolus* sp., a pest-resistant strain of rice (species unknown), and 110 plant species of importance in Ayurvedic medicine (Nair *et al.*, 1980). More detailed descriptions of the vegetation are found elsewhere (Anon., 1981, 1982).

FAUNA Faunal diversity is very high and includes a number of endemic and threatened species. Notable large mammals include lion-tailed macaque Macaca silenus (E), tiger Panthera tigris (E), elephant Elephas maximus (E) and Nilgiri tahr Hemitragus hylocrius (V). A list of large and medium-sized mammals, excluding bats, rodents and insectivores, with population estimates is provided by Balakrishnan (1984). The Zoological Survey of India assessed the faunal resources of the area in April 1979 and August 1980 and provided a brief account of the species encountered and their significance (Pillai, 1981). These include a number of possibly new species, a few very primitive animal groups, notably Caecilians (amphibians), which may be useful in investigations of phylogenetic relationships of higher taxa, several predator-prey systems of potentially great importance to biological control programmes, and the extremely rare hairy-winged bat Harpiocephalus harpia and Peshwa's bat (Anon., 1981, 1982).

CULTURAL HERITAGE Although the area is believed never to have been settled, even by hunter-gatherers (Anon. 1982; Variava, 1983), the indigenous Mudakar tribals are present (R. Whitaker, cited in Rahmani, 1980a). They cause minimal disturbance to the area.

LOCAL HUMAN POPULATION There is no officially recorded settlement in the vicinity (Anon. 1982).

VISITORS AND VISITOR FACILITIES There are few facilities and tourism is restricted. Visitors number about 1,000 per year. Accommodation can be arranged in an Inspection Bungalow (Kerala Forest Department, pers. comm., 1987).

SCIENTIFIC RESEARCH AND FACILITIES A number of studies have been generated by the controversy over the hydroelectric project. Studies not specifically mentioned above include a survey by a team of scientists appointed by the Government of Kerala to collect data on the distribution, genetic diversity and degree of endemism of the flora and fauna of Silent Valley, the adjoining Attappadi Forest, and Sabarigiri Reserved Forest in Quilon District (Anon., 1981). The results of the survey, which was limited to only one season and concentrated on vascular plants, generally contradict most other findings, including those of the Botanical Survey of India and the Zoological Survey of India. For example; it is categorically stated that no endangered or endemic species are present, although the forests are known to be an important refuge for the highly endangered lion-tailed macaque (Green and Minkowski, 1977). The uniqueness and high biological diversity of Silent Valley is also refuted with the claim that there are more biologically valuable forests elsewhere in Kerala. Silent Valley was also included in a study on the ecological impacts of hydroelectric projects (Vijaykumaran and Balasubramanyan, 1985). The likely impact of the proposed reservoir has been reviewed by Singh et al. (1984). There are no scientific facilities.

CONSERVATION MANAGEMENT The conservation value of Silent Valley's forests, with their large numbers of endemic, rare and valuable flora and fauna is now generally acknowledged, and their biological diversity is considered to be comparable to that of the Barro Colorado Island tropical rain forests (Anon., 1982). Silent Valley is an integral part of the Nilgiri ecosystem (Anon., 1982) and, with Attappadi (12,000ha), Kundas (10,000ha) and New Amarambalam (8,000ha) Reserved Forests, forms part of a 39,000ha forest tract (Swaminathan, 1983; Variava, 1983). It is one of the very few areas in Kerala

with no record of permanent human settlement or interference in the form of plantations (Anon., 1982; Variava, 1983). The Kuntipuzha is one of only two rivers in the southern Western Ghats with extensive riparian vegetation and an undisturbed, pesticide-free catchment area (Anon., 1982). The park has been zoned into core (8,451.65ha), buffer (200ha) and tourism (300ha) areas (Kerala Forest Department, pers. comm., 1987).

MANAGEMENT PROBLEMS Some disturbance has resulted from cardomom plantations near the southern boundary. After the initial decision to implement the hydroelectric project, 80% of the larger trees in the 500ha evergreen forest submergible area were removed. The park is under threat of agricultural encroachment in its headwaters region to the north/north-east (?), near the vital corridor that links it to Nilgiri Tahr Sanctuary. Relatively affluent encroachers habitually clear the forest to cultivate rubber, cardomom, pepper or other crops, before selling at a profit and repeating the process elsewhere. Such encroachment may have passed unnoticed in the future over the proposed hydroelectric project in the southern extremity of the park (A. Robertson, pers. comm., 1986).

STAFF No information

BUDGET Rs 5,600,000 (1987-1988)

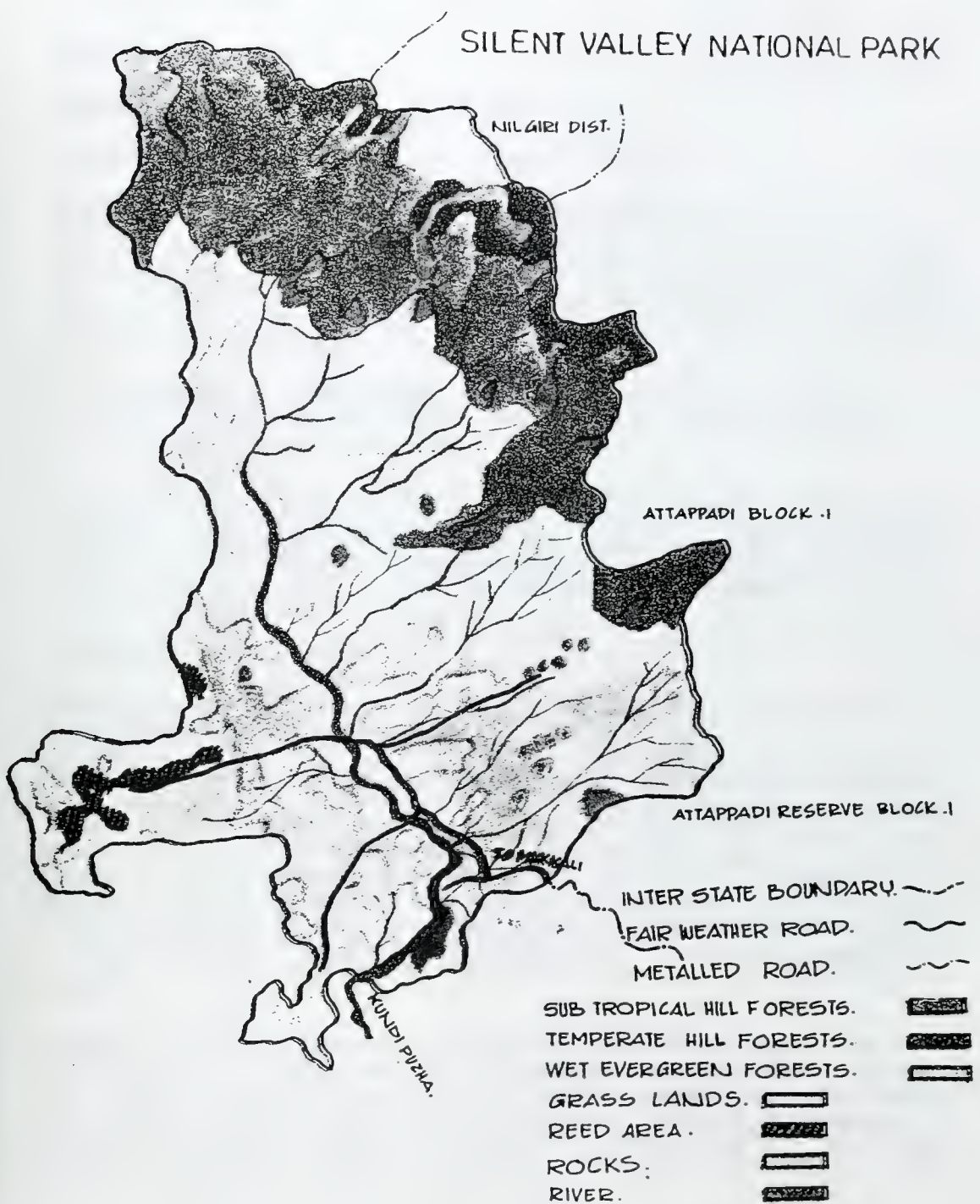
LOCAL ADMINISTRATION Wildlife Warden, Silent Valley National Park, Camp Mukkali, via Mannarghat, Palghat District

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Source: Nilla, U.S.M., (1984). Silent Valley National Park.
Kerala Forest Department., Publication No. 16.



NAME Wynad Sanctuary

MANAGEMENT CATEGORY IV (Managed Nature Reserve)

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION Situated on the Wynad Plateau, which lies at the junction of the Western Ghats, Nilgiri Hills and the Deccan Plateau. The sanctuary has been divided into two distinct parts by a belt of cultivation, the outcome of successive encroachments over more than a decade. The northern part (22,272ha) lies in Cannanore District and the southern part (25,100ha) in Calicut District. Calicut, the nearest major town, is about 110km to the north-west. 11°15'-11°55'N, 75°45'-76°30'E

DATE AND HISTORY OF ESTABLISHMENT Created a sanctuary on 30 May 1973 (G.O.M.S. 182/73/AD and SRO 348/73). The sanctuary has been included in the proposed Nilgiri Biosphere Reserve.

AREA 34,400ha. The southern part is contiguous to Bandipur National Park (87,400ha) in Karnataka along its northern and north-eastern borders, and to Mudumalai Sanctuary (32,155ha) in Tamil Nadu along its eastern borders; the northern part is contiguous to Kakanote Reserve Forest (7,007ha) to the east, which in turn is adjacent to Nagarhole National Park (57,155ha) in Karnataka (Ali *et al.*, 1985; Nair *et al.*, 1978).

LAND TENURE State government

ALTITUDE Ranges from 640m to 890m, with a mean elevation of 650m (Kerala Forest Department, pers. comm., 1987).

PHYSICAL FEATURES Wynad Plateau is a very extensive east-sloping tableland, which merges with the drier Mysore Plateau to the east and the very dry Sigur Plateau to the south-east. Wynad means 'land of swamps' and the sanctuary is characterised by gently undulating terrain dotted with 'vayals' or marshes. Marshes tend to occupy hollows between hills, typically with a stream meandering through or draining them from one end. They generally have a deep black, clayey soil that is waterlogged with up to 30-50cm of standing water during the monsoons. The plateau is drained by a large number of perennial streams, which flow east into the Kabini River (Nair *et al.*, 1978; Anon., 1982).

CLIMATE Temperatures vary from 13°C to 35°C. Rainfall increases from east to west. Nair *et al.* (1978) reported an annual range of 1524-2540mm, but this is much lower than contemporary recordings of 4500mm (Kerala Forest Department, pers. comm., 1987). Maximum precipitation occurs from June to September during the south-west monsoon, but there is considerable rainfall during the north-east monsoon in October and November. February is generally the driest month and July the wettest (Nair *et al.*, 1978).

VEGETATION Moist deciduous forest is the climax vegetation of the area, and tends to occur in areas having an annual rainfall of 1100-1900mm. Except along the western edges and in a few other pockets, climatic conditions do not favour the formation of climax evergreen vegetation. Despite teak extraction, two moist deciduous forest sub-types are still discernible: forests with and

without teak Tectona grandis in areas of lower and higher rainfall, respectively. Where teak is predominant, the forest generally attains a height of about 20m and the canopy is more or less closed; the soil is reddish and deep, and typically supports a thin herbaceous cover. The marshes generally have a very lush growth of grasses and the best bamboo Bambusa arundinacea occurs along their edges. Nair et al. (1978) provide a more detailed description of the vegetation, including lists of common tree, shrub, climber and grass species.

FAUNA Bonnet macaque Macaca radiata is principally found near human habitations. Carnivore species include tiger Panthera tigris (E), leopard P. pardus (V), sloth bear Melursus ursinus (I), wild dog Cuon alpinus (V), jackal Canis aureus and possibly also Indian fox Vulpes bengalensis. Elephants Elephas maximus (E) migrate from the sanctuary during both monsoons, returning during the dry season. There is a small gaur Bos gaurus (V) population. Other herbivores include sambar Cervus unicolor, spotted deer Cervus axis, Indian muntjac Muntiacus muntjak and black-naped hare Lepus nigricollis. Despite heavy poaching pressure, wild boar Sus scrofa is relatively abundant. Giant squirrel Ratufa indica is also present.

CULTURAL HERITAGE No information

LOCAL HUMAN POPULATION There are no details of the size of the local population, but it seems to be substantial and includes plantation workers, cultivators, encroachers and Chetties (Nair et al., 1978).

VISITORS AND VISITOR FACILITIES There are some 550 visitors per year (Kerala Forest Department, pers. comm., 1987). No information is available concerning facilities.

SCIENTIFIC RESEARCH AND FACILITIES Along with Mudumalai Sanctuary, Bandipur and Nagarhole National Parks, the area was included in a feasibility study of managing the wildlife as a single management unit, namely Jawahar National Park. It was also included in a study of the ecology and habitat of the Indian elephant (Ali et al., 1985). There are no scientific facilities.

CONSERVATION MANAGEMENT Wynad forms part of one of the most extensive forested areas of Peninsular India, which harbours the second largest elephant population in the country (Daniel, 1980). In particular, it is a vital refuge to elephants during the dry season when large numbers visit the sanctuary for food and water (Nair et al., 1978). A management plan is currently in preparation, in which a system of zonation will be outlined (Kerala Forest Department, pers. comm., 1987).

MANAGEMENT PROBLEMS Much of the sanctuary is highly degraded and/or heavily disturbed. Between 1968 and 1978, 10,117.25ha of the Pulpally vested forests, occupying a 8-13km stretch along the south bank of the Kabini, were clearfelled for cultivation, thereby dividing the sanctuary into two discrete units. These encroachments, along with the far-reaching effects of the Kabini Hydroelectric Project north of the sanctuary in Karnataka, pose the most serious and immediate threats to the region's elephants, greatly reducing their habitat and disrupting many traditional migration routes. 12,350ha were inundated and a further 24,700ha cleared for resettlement of inhabitants displaced by the Kabini Project. Suitable elephant habitat is now restricted to the north-eastern portion of the sanctuary. According to C.C. Mathew (1985), elephants continue to be captured (even under the aegis of the Forest

Department) despite the banning of this activity in Kerala in August 1979, following the recommendation of the Indian Board for Wildlife. Most of the fertile land along stream and river banks and marshes, areas also favoured by wildlife, have been cultivated by either Chetties on Forest Department leases, or encroachers. The former do not unduly disturb the wildlife, but conflict is inevitable, with crop raiding by elephants and cattle lifting by leopards and other large predators. Numerous other problems exist such as poaching, annual burning from January to March, fuelwood and forest produce collection and cattle grazing (see Nair et al., 1978). The Forest Department is poorly equipped in terms of staff, weapons and transport to deal with these problems.

STAFF No information

BUDGET Rs 2,500,000 (1987-88)

LOCAL ADMINISTRATION Wildlife Warden, Wynad Sanctuary, Sultan's Battery, Wynad District

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DATE February 1988
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NAME Mudumalai Sanctuary

MANAGEMENT CATEGORY IV (Managed Nature Reserve)

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION The sanctuary lies on the northern and north-western side of the Nilgiri (Blue Mountains), about 80km north-west of Coimbatore in the extreme north-western corner of Tamil Nadu, on the interstate boundaries with Karnataka and Kerala. The northern boundary follows the state border (Sharma et al., 1978). 11°32'–11°43'N, 76°22'–76°45'E

DATE AND HISTORY OF ESTABLISHMENT Created in 1940 to become the first sanctuary in southern India (Sestiadti, 1986). Proposals have been made to designate part of the sanctuary as a national park, enlarge it and create a migratory corridor linking the sanctuary with Sigur and Anaikatti reserve forests (Rodgers and Panwar, 1988). The site is included in the proposed Nilgiri Biosphere Reserve (Gadgil and Sukumar, 1986).

AREA 32,100ha. Originally 6,000ha, the sanctuary was enlarged to 29,500ha in 1956 and subsequently to its present size. Proposals exist and designate 20,000ha as a national park, to extend the sanctuary by 5,000ha and to create a 20,000ha migratory corridor. The area is contiguous with Bandipur National Park (87,400ha), Wynad Sanctuary (34,400ha), Sigur and Singara reserve forests (Rodgers and Panwar, 1988).

LAND TENURE State

ALTITUDE Ranges from 350m to 1266m at Markundarai Betta (Sharma et al., 1978).

PHYSICAL FEATURES The terrain of this tract of the Nilgiri is extremely varied, with hills, valleys, ravines, flats, water courses and swamps. Many streams drain the area, the principal ones being: Moyar, which flows along the borders of Tamil Nadu and Karnataka; Benne Hole, draining the western part of the sanctuary; and Bide Halla, which flows into the Moyar. The Moyar is the most importance source of water in the sanctuary, since most of the other streams dry up in early June. Rocks are typical archaean biotite and hornblende gneiss, with intensive bands of charnokite and much younger biotite-granite, pegmatite and basic dolerite dykes. Two kinds of soil, namely black sandy loam and red heavy loam, can be distinguished. The red soil is confined to the southern part of the sanctuary (Sharma et al., 1978).

CLIMATE Conditions are warmer than elsewhere in Nilgiri District. April, May and June are the hottest months, and December and January the coldest. Mean annual rainfall is about 1420mm. The western side receives more rainfall than the eastern during the south-west monsoon (June–September). In the eastern side, most of the rain falls during the north-east monsoon (October–December) (Sharma et al., 1978).

VEGETATION There are three main types of forest: tropical moist deciduous, tropical dry deciduous and southern tropical thorn. In certain places mixed vegetation types are present. Tropical moist deciduous forest occurs in the western Benne Block, where rainfall is higher than in the other blocks. Bambusa arundinacea is a characteristic associate. Prominent tree species

are: Terminalia tomentosa, T. bellerica, Schleichera oleosa, Butea monosperma, Linociera malabarica, Scherbera swietenoides and Pterocarpus marsupium. Evergreen shrubs include Toona ciliata, Euodia lunuankenda, Glochidion velutinum and Viburnum punctatum. The undergrowth consists of Antidesma diandrum, Clerodendrum servatum, C. viscosum, Desmodium pulchellum, Flemingia strobilifera, F. wightiana and Callicarpa tomentosa. Tropical dry deciduous forest is confined to the eastern side but merges into thorn forest, where rainfall is lowest. Common tree species include Anogeissus latifolia, Buchanania lanzan, Tectona grandis, Diospyros montana, Semecarpus anacardium, Givotia rottleriformis, Lannea coromandeliana, Dalbergia latifolia, Bombax ceiba, Madhuca indica, Gmelina arborea, Mitragyna parvifolia and Wrightia tinctoria. Southern tropical thorn forest, also known as scrub jungle, occurs in parts of Avarihalla, Moyar and Bokkapuram blocks. Thorny and fleshy species, both of which are xerophytic adaptations, are characteristic of this vegetation type. Acacia chundra and A. leucophloea are dominant; associates include Albizia amara, Canthium parviflorum, Xeromphis spinosa, Zizyphus oenoplia, Capparis grandiflora, C. sepiaria, Barleria buxifolia, B. mysorensis and B. prionitis. Narrow belts of riverine vegetation occur along stream banks, notably the Moyar. Prominent species are Linociera malabarica, Salix tetrasperma, Bischofia javanica, Terminalia arjuna, Vitex altissima, Diospyros peregrina, D. assimilis, Drypetes roxburghii, Memecylon edule and Mallotus muricatus (Sharma et al., 1978; Jain et al., 1983). There are teak plantations, particularly in Benne Block, and a eucalyptus plantation in the Masinagudi area. Bamboo plantations, for rayon mills in Kerala, have also gained in importance (Jain et al., 1983).

FAUNA Primates are langur Presbytis entellus and bonnet macaque Macaca radiata. Tiger Panthera tigris (E) is widespread, whereas leopard P. pardus (T) is most often seen in the Kargudi area. Other carnivores include wild dog Cuon alpinus (V), which is common, especially in Masinagudi and Theppakkadu blocks, striped hyena Hyaena hyaena, jackal Canis aureus and sloth bear Melursus ursinus (I). The elephant Elephas maximus (E) population totals 300–400 animals (Salim et al., 1985). Ungulates include small numbers of gaur Bos gaurus (V), sambar Cervus unicolor, spotted deer C. axis, Indian muntjac Muntiacus muntjak, mouse deer Tragulus meminna, which is ubiquitous, and wild boar Sus scrofa. Rodents include giant squirrel Ratufa indica maxima and flying squirrel Petaurista petaurista.

Bird life is rich. Regional endemics include Malabar trogon Harpactes fasciatus and Malabar grey hornbill Tockus griseus. Predatory birds include crested hawk-eagle Spizaetus cirrhatus and crested serpent eagle Spilornis cheela. Of the reptiles, monitor lizard Varanus bengalensis is the most regularly observed species (Nair, 1978; Israel and Sinclair, 1987).

CULTURAL HERITAGE There are several Kurumba and Irula tribal settlements and some Chetty cultivations of wials (swamp) in forested tracts of Nilgiri Wynad (MAB, 1980).

LOCAL HUMAN POPULATION In 1985 there were 12 villages within the sanctuary, occupying a total of 260ha of patta land and surrounded by moist deciduous and semi-evergreen forest (Salim et al., 1985). Much of the sanctuary is exploited for forest produce. There are 10,000–20,000 cattle in Masinagudi and Moyar areas (Salim et al., 1985).

VISITORS AND VISITOR FACILITIES Accommodation includes a forest rest house and guest houses at Masinagudi, and guest houses at Kargudi, Abhayaranyam and Theppakkadu. The nearest airport is at Coimbatore (84km) and the closest railhead at Udthagamandalam (64km) (Sestiadti, 1986).

SCIENTIFIC RESEARCH AND FACILITIES The earliest plant collections were made by Beddome et al. (1956) for the Botanical Survey of India. More recent ecological studies were carried out between 1970 and 1973 by Sharma et al. (1978). Research on bonnet macaque was carried out from 1981 to 1982 by Sahi (1985).

CONSERVATION MANAGEMENT Mudumalai is an important part of the Nagarhole-Bandipur-Mudumalai complex, which is rich in wildlife and forms part of the proposed Nilgiri Biosphere Reserve. Salim et al. (1985) suggested that steps should be taken to reduce the numbers of cattle in the sanctuary and to relocate residents elsewhere. The sanctuary is split into a wilderness zone, sanctum sanctorum, optimum forestry or integrated zone, intensive development or tourism zone, administrative zone, buffer zone and experimental zone (Joseph, n.d.).

MANAGEMENT PROBLEMS Some areas, especially Masinagudi and Moyar, are highly degraded from human impact and overgrazing by cattle. Cattle also disturb elephants, compete with wildlife for pasture and introduce diseases, such as rinderpest, which reduced the gaur population in 1968 (Nair et al., 1978; Salim et al., 1985; Indian Wildlife, 1987). Timber extraction includes both selective and clear felling, the latter damaging forests (Jain et al., 1983).

STAFF Wildlife warden, forest veterinary officer, five range officers, nine foresters, 21 forest guards and 28 reserve watchers

BUDGET No information

LOCAL ADMINISTRATION Wildlife Warden, Mudumalai Sanctuary, Udthagamandalam, Tamil Nadu

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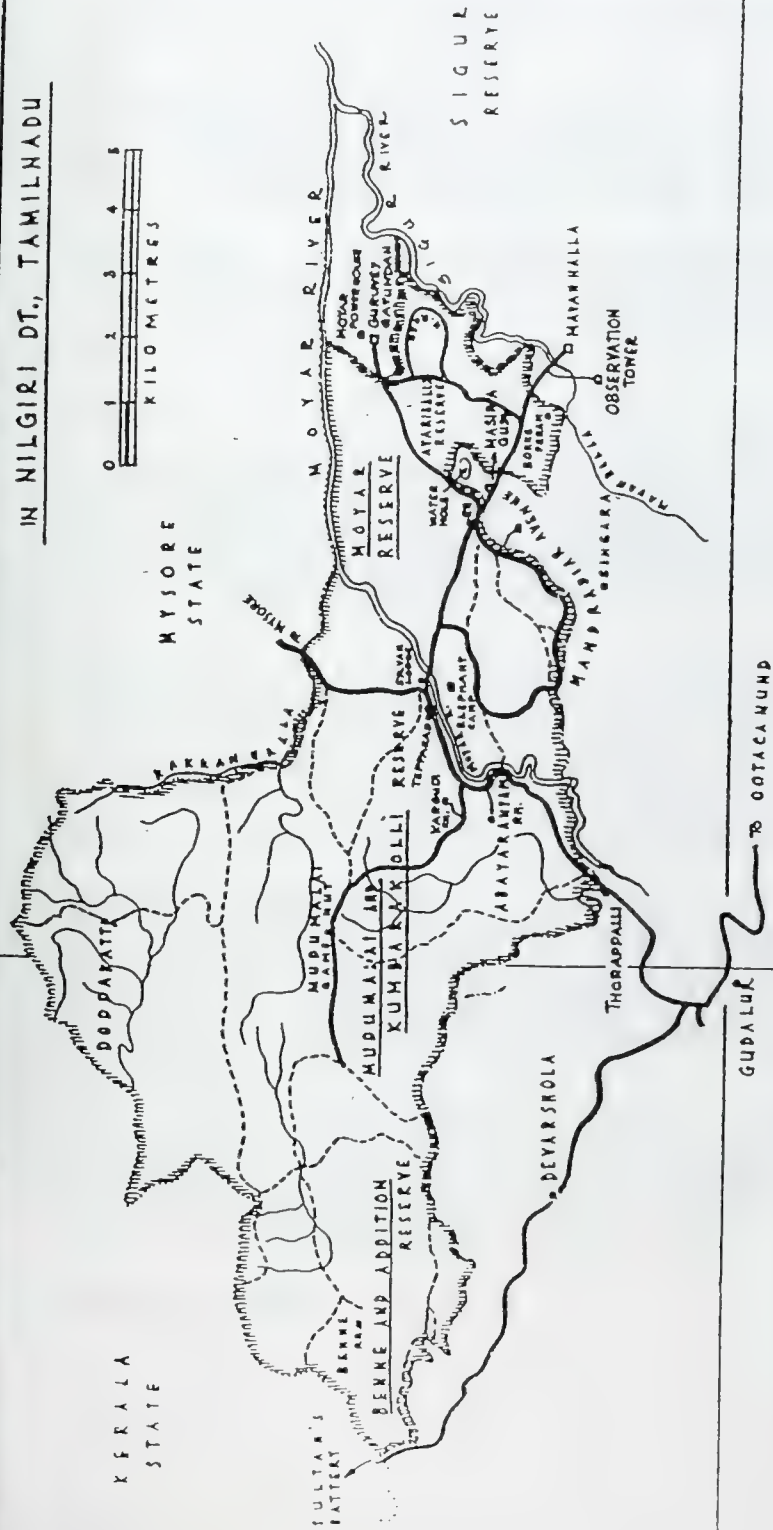
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Source: Sharma et al., (1978). Flora of Mudumalai
Wildlife Sanctuary, Tamil Nadu. Journal of the
Bombay Natural History Society. 75: 13-42.

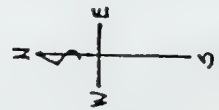
MUDUMALAI WILDLIFE SANCTUARY

IN NILGIRI DT., TAMILNADU



KEY

- STATE BOUNDARY
- WILDLIFE SANCTUARY BOUNDARY
- RIVER, STREAM
- ROADS, METALLED
- ROADS, UNMETALLED
- RESTHOUSES



NAME Nilgiri Tahr Sanctuary

MANAGEMENT CATEGORY IV

BIOGEOGRAPHICAL PROVINCE 4.01.01 (Malabar Rainforest)

GEOGRAPHICAL LOCATION Lies in the west of Tamil Nadu on the interstate border with Kerala. The town of Coimbatore is 50km to the south-east.
 7°11'12"-11°21'N, 76°27'-30°33'E

DATE AND HISTORY OF ESTABLISHMENT Designated a sanctuary on ?. It is proposed for upgrading to national park status (Rodgers and Panwar, 1988). The sanctuary constitutes part of the core area of the proposed Nilgiri Biosphere Reserve (Gadgil and Sukumar, 1986).

AREA 7,846ha. Contiguous to Silent Valley National Park (8,951ha), proposed Karimpuzha National Park (25,500ha) and Attapadi and Upper Bhavani reserve forests (Rodgers and Panwar, 1988; Gadgil and Sukumar, 1988).

LAND TENURE State

ALTITUDE 1,800 - 2,500m (Rodgers and Panwar, 1988)

PHYSICAL FEATURES Information on its exact location is not yet available, but it is assumed that the sanctuary constitutes part of the Upper Nilgiri Plateau and overlooks New Amarabalam and Silent Valley, and also that the rivers flow south and west, draining into the adjacent Upper Bhavani Reservoir. Rocks are mostly pre-Cambrian: charnokites, gneisses and schists (Gadgil and Sukumar, 1986).

CLIMATE Rainfall is high (1,832mm at Bangi-Tappal, 1984), due to the combined influence of the summer monsoon (June to August) and early rains (April). The northern part of the sanctuary is much wetter than the south, the dry season being only two months in duration (January to February) compared to three months (January to March) in the south. Mudimund to the north of the sanctuary has an annual rainfall of 3,505mm, one of the highest in the Nilgiris. Mean temperature is below 13°C (Meher-Honji, 1987).

VEGETATION Natural vegetation is characterised by montane shola-grassland and shola-forest. Principal trees include Cinnamom wightii, Elaeocarpus spp., Gardonia obtusa, Meliosma spp., Liquostrum voxburghii, Litsaea spp., Schefflera spp., Symplocos spp., and Syzygium arnottianum. Grassland species belong to the genera Cymbopogon, Themeda, Eragrostis, Bothriochloa and Tripogon. Part of the area is planted with blue gum and wattle (Gadgil and Sukumar, 1986).

FAUNA Noteworthy mammals within the sanctuary include elephant Elaphas maximus (E), and the endemics nilgiri tahr Hemitragus hylocrius (V) and nilgiri langur Presbytis johni (Rodgers and Panwar, 1988). There are an estimated 400 Nilgiri tahr in the sanctuary, which represents the northern limit of the species' distribution (Rice, 1984).

CULTURAL HERITAGE No information

LOCAL HUMAN POPULATION No information

VISITORS AND VISITOR FACILITIES No information

SCIENTIFIC RESEARCH AND FACILITIES The Indian Institute of Science included the Nilgiri and Wynad areas in a survey of the proposed Nilgiri Biosphere Reserve in 1980 (Gadgil and Sukumar, 1986). The Nilgiri Tahr population has been repeatedly censused (Davidar, 1963, 1976, 1978; Rice, 1984). Other work includes research on butterflies (Larson, 1986) and the avifauna of the shola vegetation (Khan, 1978).

CONSERVATION MANAGEMENT There is no management plan at present but the sanctuary will be managed as part of the core zone of the proposed Nilgiri Biosphere Reserve (Gadgil and Sukumar, 1986).

MANAGEMENT PROBLEMS No information

STAFF No information

BUDGET No information

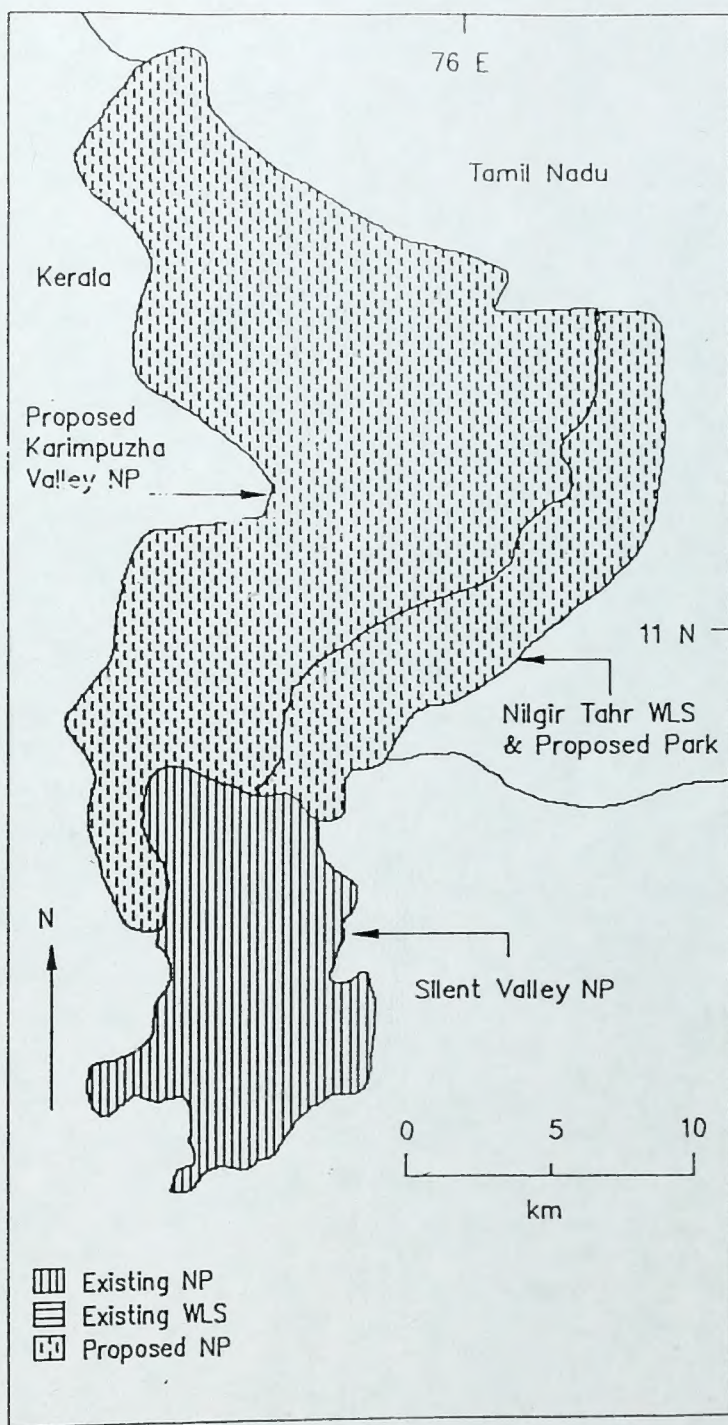
LOCAL ADMINISTRATION No information

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Source: Rodgers, W.A. and Panwar, H.S. (1988). Planning a wildlife protected area network in India. Volumes I and II. Wildlife Institute of India, Dehra Dun. 341 pp and 267 pp.

